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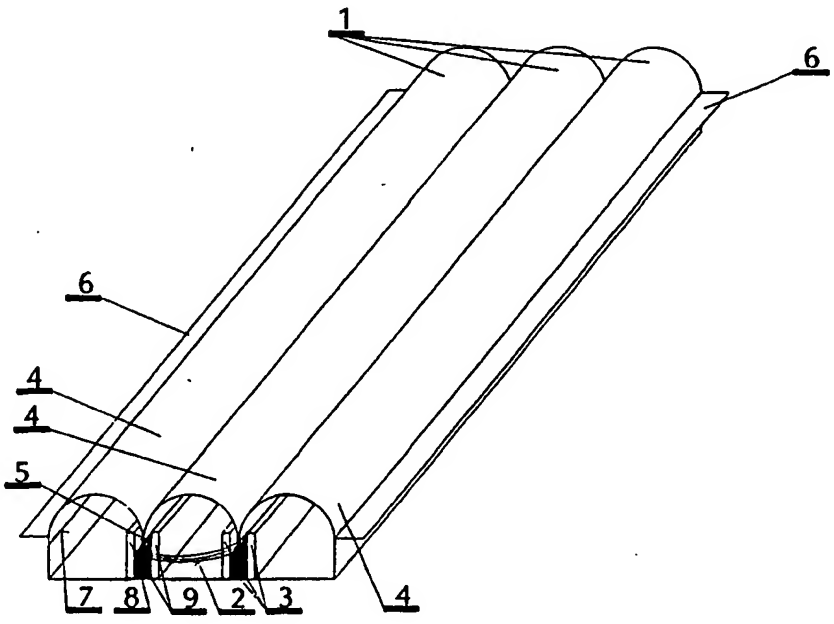
(54) Title: WIDE BAND LOUDSPEAKER WITH STRIP DIAPHRAGM

(57) Abstract

A wide–band loudspeaker comprising strip diaphragm to which electrically conductive wires (2) are connected, and magnets (3) having air–gaps. The diaphragm (1) consists of one or more, preferably two strips (4) having a quadrilateral shaped surface, the strips (4) are arcuated along their longitudinal axis, and along their adjacent edges they form parallel double edges (5). In case of separate strips (4) the adjacent edges are fixed to each other. The outer edge (7) of the outside strips (4) and the positioning of the magnet (3) are fixed relative to each other, and the double edges (5) are positioned in the air–gaps preferably along their entire length, and in one or more windings the electrically conductive wire (2) is fixed to the double edges (5).



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Wide band loudspeaker with strip diaphragm

Loudspeakers operating with strip diaphragm are known and have been applied for a long time because they produce less distortion in the sound and their loadability is greater than of any other type.

Hungarian Patent Application No. 2588/81 describes a loudspeaker capable for good quality acoustic reproduction, having a diaphragm of metal foil and prismatic magnet legs are provided on both sides of it.

The disadvantage of this solution is that a large magnet is needed for the loudspeaker which considerably increases the weight and the cost of it, and the diaphragm made of metal foil distorts the acoustic tone.

The US 4703510 Patent Application describes a transducer diaphragm or membrane which includes a folded sheet of thin film material. The sheet is folded in such way that so called legs are formed having printed circuit conductors thereon in a serpentine pattern. Next to the legs air-gaps of permanent magnets are formed.

This method requires extremely complicated technology and it is very expensive, because too much magnet is needed for construction which causes increase in size, and the stiffening effect of the legs arranged in the middle part of the diaphragm spoils the quality of acoustic reproduction.

To eliminate the above mentioned disadvantages the object of the invention is to provide a loudspeaker with strip diaphragm capable for more accurate acoustic reproduction with a less complicated and therefore less expensive arrangement.

It has been found that by forming the diaphragm from strips which are secured to each other by adhesive bonding and are arcuated along their longitudinal axis, the system becomes self-sustaining, further by arranging electrically conductive wires along the adhesive bonding, the material of the diaphragm instead of electrically conductive material can be of any kind resulting better quality in sounds during reproduction.

The object of the invention is a wide-band loudspeaker with strip diaphragm to which electrically conductive wires are connected, and comprises magnets having air-gaps. The diaphragm consists of one or more, preferably two strips, having a quadrilateral shaped surface, the strips are arcuated along their longitudinal axis, and along their adjacent edges they form parallel double edges. In case of separate strips the adjacent edges are fixed to each other. The outer edge of the outside strips and the positioning of the magnet are fixed in accordance with each other. The double edges are positioned in the air-gaps preferably along their entire length, and in one or more windings the electric wire is fixed to the double edges.

Advantageously the outer edge of the outside strips and the magnets are fixed to each other by a supporting means which can be constructed from one or more parts.

In the preferred embodiment the magnet is made of soft iron blocks fitted to a permanent magnet, and the air-gap is formed between the soft iron blocks or the magnet is an electromagnet.

The ends of the electrically conductive wire are connected to connecting points.

Advantageously the strip is made of a material of high acoustic conductivity and inner vibration absorption, preferably plastic.

The loudspeaker according to the invention will be described in details with reference to the accompanying drawings.

Fig. 1 is the perspective view of one preferred embodiment of the loudspeaker with strip diaphragm according to the invention.

Fig. 2 is a cross section of the loudspeaker with strip diaphragm of Fig. 1.

Fig. 3 is a cross section of A-A.

Fig. 4 is a cross section top plane view of an other embodiment according to the invention with four double edges and also showing a method for directing the electrically conductive wire.

Fig. 5 is a cross section top plane view of the embodiment according to Fig. 4, but the arrangement of the electrically conductive wire fitted to the double edge is different.

Fig. 6 shows the cross section of a loudspeaker and diaphragm consisting of four strips.

Fig. 7 shows the cross section of the loudspeaker according to Fig. 2 but the positioning of the diaphragm is reversed.

Fig. 8 shows the cross section of the loudspeaker according to Fig. 6 but the positioning of the diaphragm is reversed.

Fig. 9 and 10 is a cross section for the possible embodiment of the diaphragm formed from one strip.

Fig. 11 and 12 shows the cross section of the embodiment in which the electrically conductive wire is directed inside the diaphragm formed from one strip.

The loudspeaker with strip diaphragm according to the invention comprises 1 diaphragm, an electrically conductive wire 2 and magnet 3. The diaphragm 1 is formed from strips 4, which have quadrilateral shaped surface. According to the embodiment of Fig. 1 the diaphragm consists of three strips 4 which have oblong surface. The strips 4 are arcuated along their longer axis, and are fixed together by adhesive bonding along their longer edges. They can be formed from one strip as it is shown in Fig. 9-12. In the cross sections of Fig. 9-12 a diaphragm 1 formed from one strip can be seen, and the electrically conductive wire 2 is directed inside the double edge 5 according to Fig. 11 and 12. The preferred formation can be set to the given manufacturing process. The edges which are fixed together by adhesive bonding or bent next to each other form double edge 5. It should be noted here that the diaphragm 1 can be manufactured in one step by moulding (for example in a pattern) and in this case both bending and adhesive bonding can be omitted. The outer edge 7 of the outside strips 4 is secured by adhesive bonding to supporting means 6. Also fixed to the 6 supporting means there are magnets 3. The

magnets 3 can be fixed by adhesive bonding or by any preferred known mechanical fixing means. The wire 2 is secured by adhesive bonding to the double edge 5, so that it encircles the two double edges 5 in more windings. The ends of the wire 2 are fixed to connecting points 11. The 3 magnet comprises two soft iron blocks 9 which are secured to two sides of permanent magnet 8 in a known way, so creating the air-gap 10 in which the double edge 5 with the wire 2 secured thereto are arranged. The material of the strip 4 is plastic having carbon filament reinforcing, but any other material which is properly rigid can be suitable, for example paper. The material of the strip 4 has an effect on the one hand on the acoustic quality, on the other hand on the durability of the loudspeaker structure.

The wide band loudspeaker according to the invention operates as follows.

The soft iron blocks 9 secured to the magnet 3 create a magnetic field in the air-gap 10 which is formed between them, the magnetic field is perpendicular to the longitudinal axis of the wire 2 and the double edge 5. Through the connecting points 11 acoustic-frequency current is introduced to the wire 2, and it causes electrodynamic interaction with the magnetic field. Due to this interaction acoustic-frequency impulses arise distributed in the wire 2. The mechanical vibration due to the impulses is transferred to strips 4 through the double edge 5, and the strips transfer this vibration directly to the surrounding air-gap.

Fig. 4 and 5 show a preferred embodiment, where the diaphragm 1 is constituted by five strips 4, therefore the number of the magnets 3 is four. The windings in the embodiment shown in Fig. 4 are S-shaped and comprise more sections of wire 2, the windings in the embodiment shown in Fig. 5 encircle the double edges 5 like a multiple 8-shape. The construction and operation of the loudspeaker created this way is the same as it is described in connection with Fig. 1. The windings in Fig. 6, 7 and 8 are in accordance with the one shown in Fig. 2 and 3, the electrically conductive wire is in the air-gaps 10.

The advantage of the wide band loudspeaker according to the invention is, that a single loudspeaker is capable for emitting the entire perceivable acoustic range, and further capable for emitting hi-fi quality sounds from 35 Hz to even 30 kHz. The geometric dimensions of the diaphragm keeps the self-vibration of the diaphragm on a low level.

Claims

1. Wide-band loudspeaker which comprises strip diaphragm (1) to which electrically conductive wires (2) are connected, and magnets (3) having air-gaps (10), characterised in that the diaphragm (1) consists of one or more, preferably two strips (4) having a quadrilateral shaped surface, the strips (4) are arcuated along their longitudinal axis, and along their adjacent edges they form parallel double edges (5), in case of separate strips (4) the adjacent edges are fixed to each other, the outer edge (7) of the outside strips (4) and the positioning of the magnet (3) are fixed relative to each other, and the double edges (5) are positioned in the air-gaps (10) preferably along their entire length, and in one or more windings the electrically conductive wire (2) is fixed to the double edges (5).

2. The loudspeaker according to claim 1 characterised in that the outer edge (7) of the outside strips (4) and the magnets (3) are fixed to each other by a supporting means (6) consisting of one or more parts.

3. The loudspeaker according to claim 1 or 2 characterised in that the magnet (3) is made of soft iron blocks (9) fitted to a permanent magnet (8), and the air-gap (10) is formed between the soft iron blocks (9).

4. The loudspeaker according to claim 1 or 2 characterised in that the magnet (3) is an electromagnet.

5. The loudspeaker according to any of the claims 1-4 characterised in that the ends of the electrically conductive wire (2) are connected to connecting points (11).

6. The loudspeaker according to any of the claims 1-5 characterised in that the strip (4) is made of a material of high acoustic conductivity and high inner vibration absorption, preferably plastic.

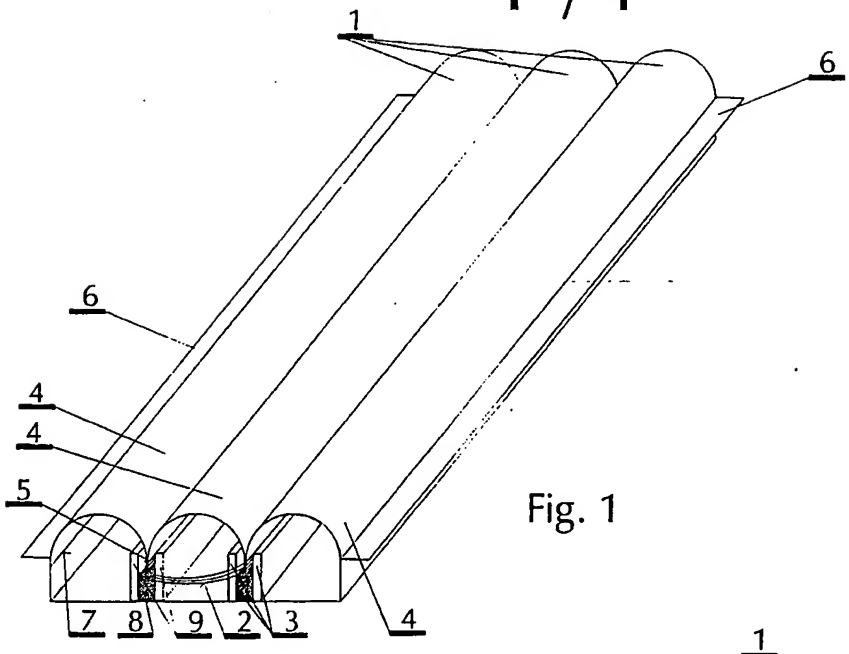


Fig. 1

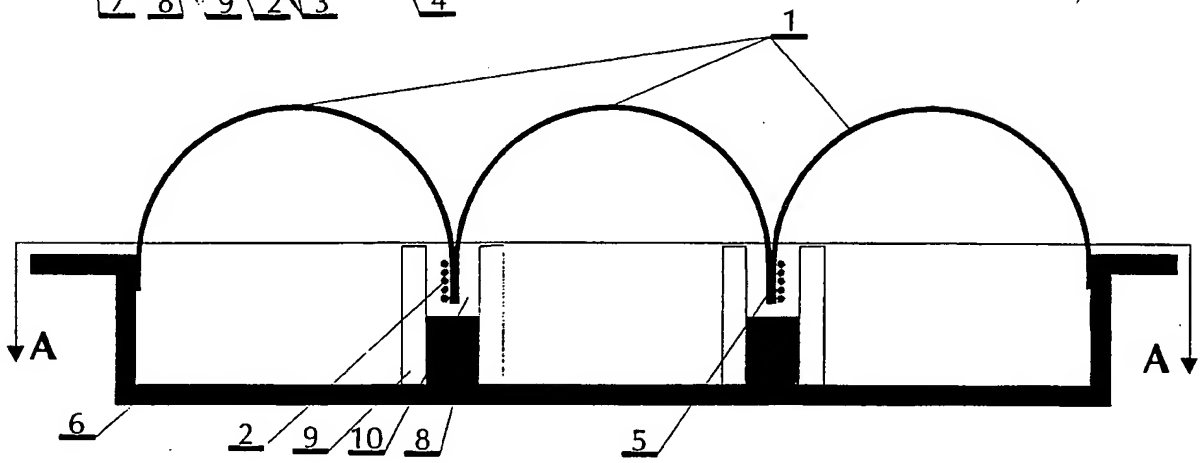
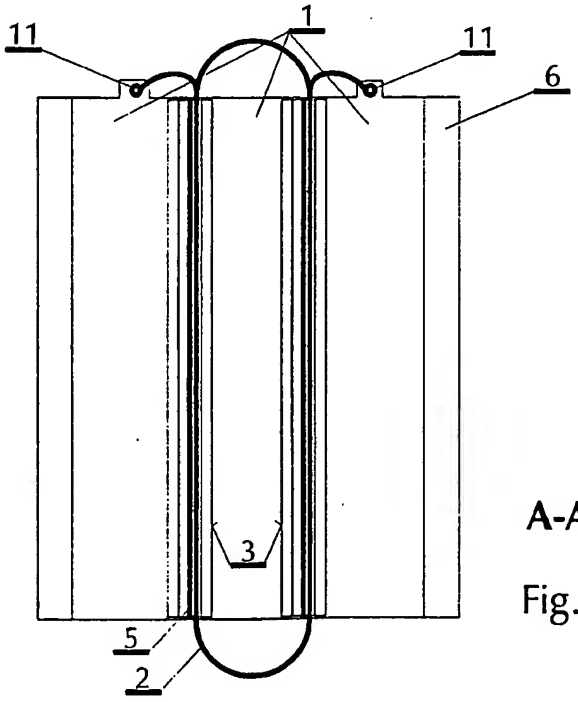


Fig. 2



A-A

Fig. 3

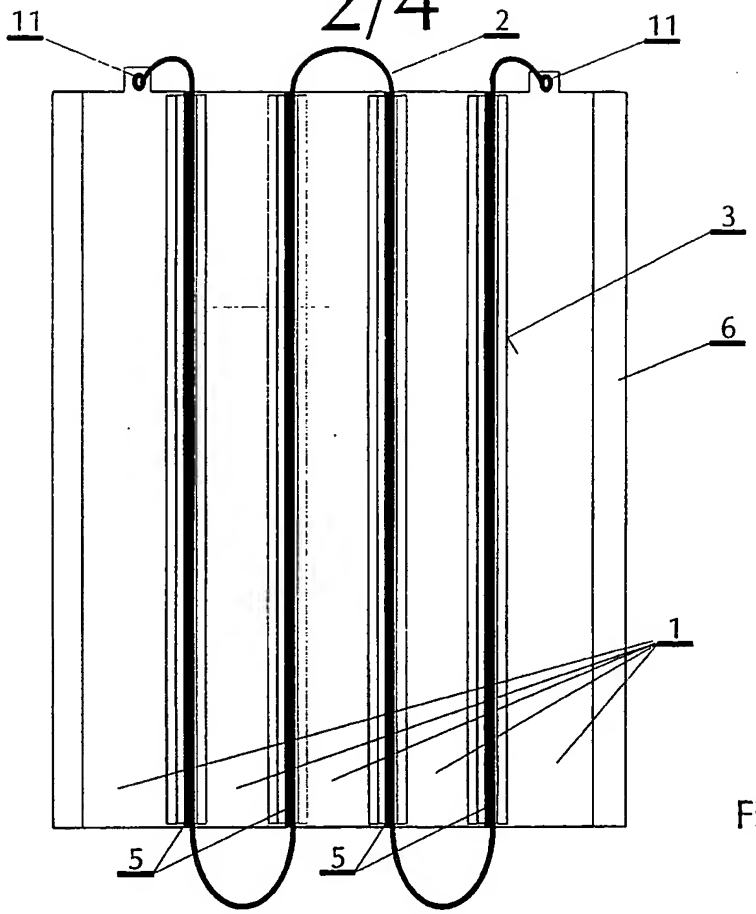


Fig. 4

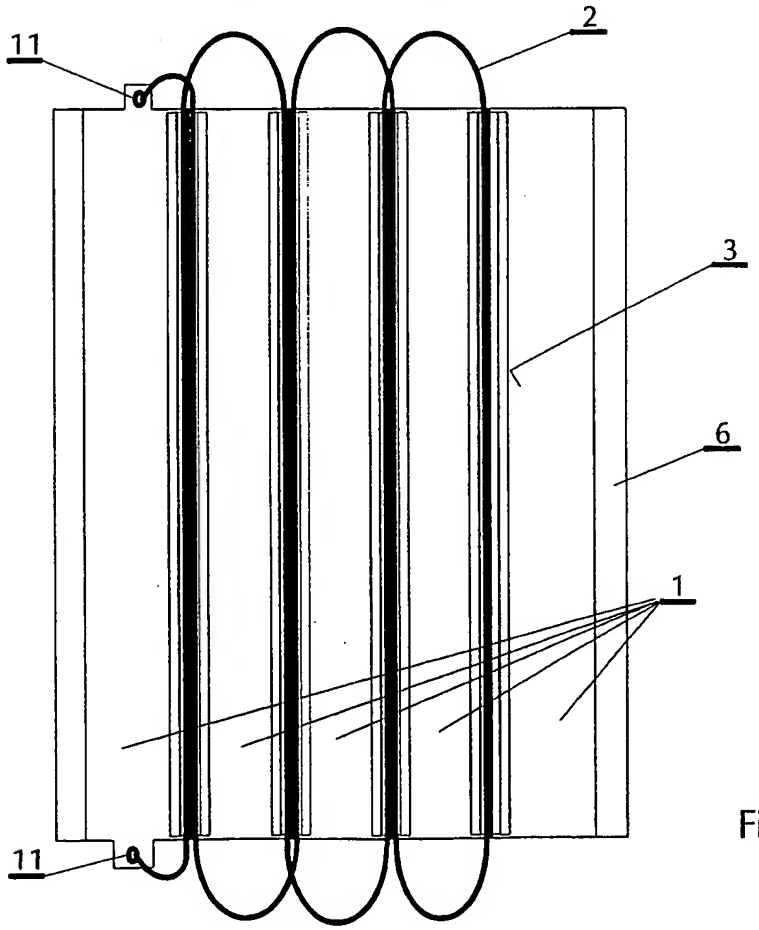


Fig. 5

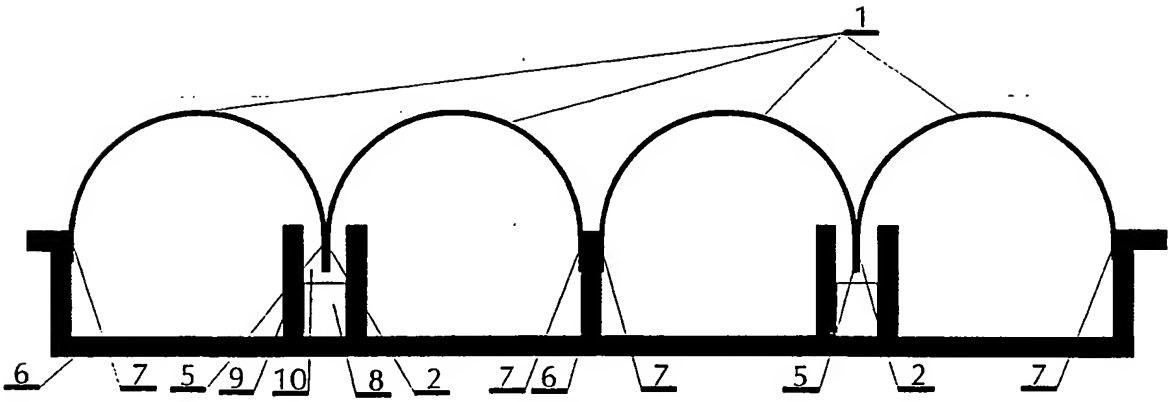


Fig. 6

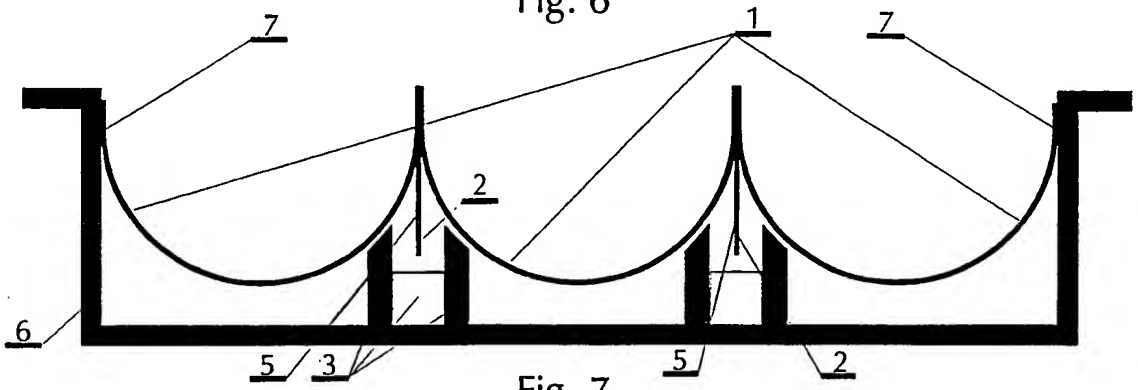


Fig. 7

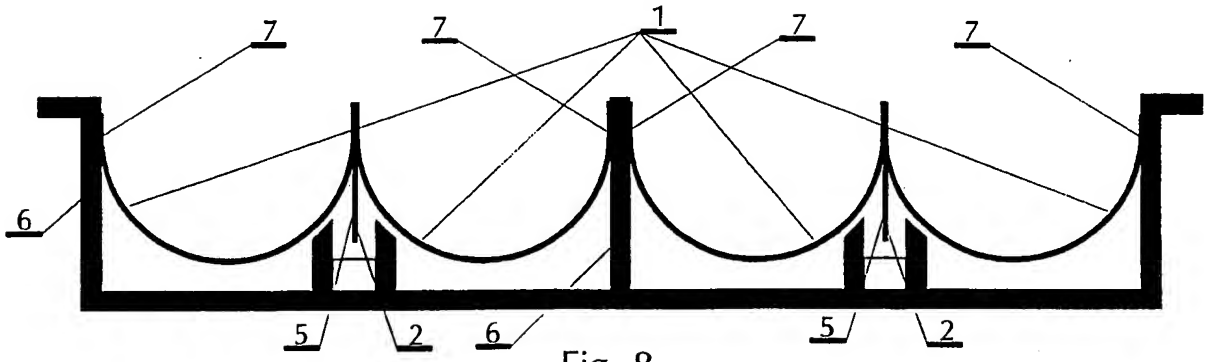


Fig. 8

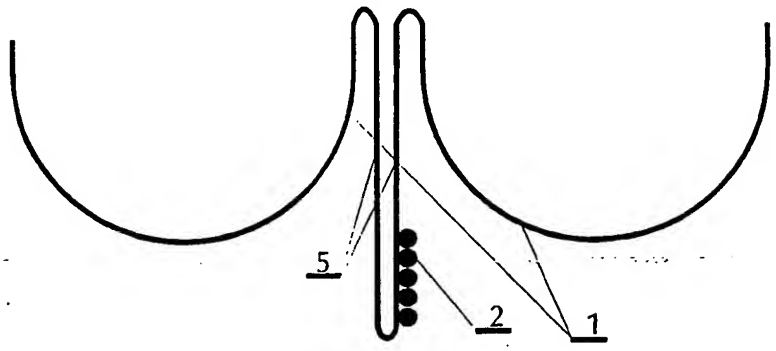


Fig. 9

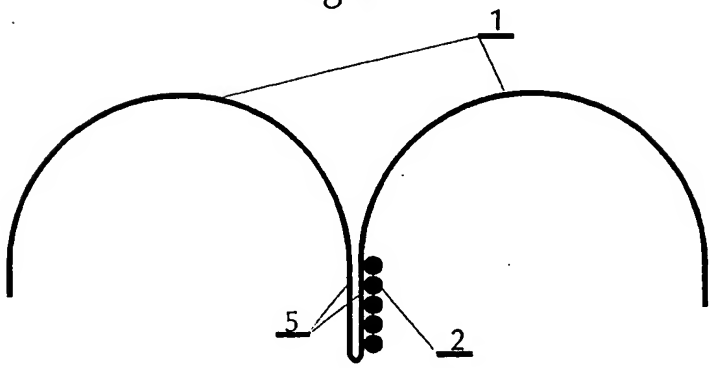


Fig. 10

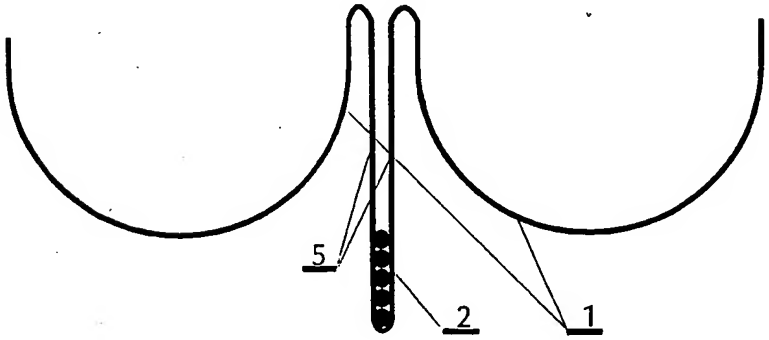


Fig. 11

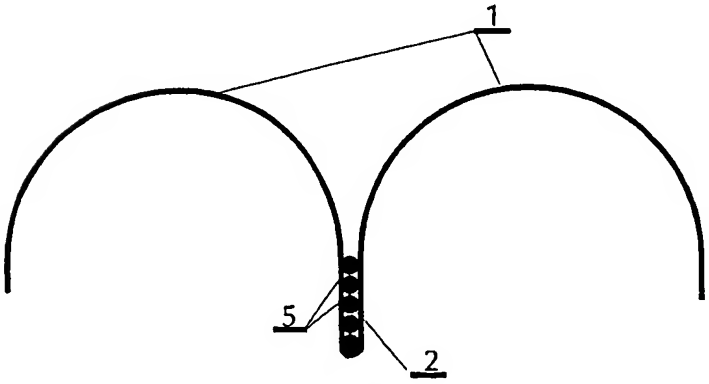


Fig. 12